CLAIMS

What is claimed is:

1. A viscoelastic polyurethane foam having a density of greater than two and a half pounds per cubic foot, said foam substantially free of flame retardant and comprising a reaction product of:

an isocyanate component substantially free of toluene diisocyanate,

an isocyanate-reactive blend comprising,

a first isocyanate-reactive component having a weight-average molecular weight of from 2500 to 4500, a hydroxyl number of from 30 to 50, and comprising at least 60 parts by weight of ethylene oxide based on 100 parts by weight of said first isocyanate-reactive component, and

a second isocyanate-reactive component having a weight-average molecular weight of from 1000 to 6000, a hydroxyl number of from 20 to 500, and comprising at most 30 parts by weight of ethylene oxide based on 100 parts by weight of said second isocyanate-reactive component,

wherein said first isocyanate-reactive component is used in an amount of from 40 to 75 parts by weight and said second isocyanate-reactive component is used in an amount of from 25 to 60 parts by weight, based on 100 parts by weight of said isocyanate-reactive blend; and

a chain extender having a weight-average molecular weight of less than 1,000 and having a backbone chain with from two to eight carbon atoms, wherein said chain extender is used in an amount of from 5 to 50 parts by weight based on 100 parts by weight of said foam.

2. A viscoelastic polyurethane foam as set forth in claim 1 wherein said second isocyanate-reactive component includes at least three isocyanate-reactive groups.

3. A viscoelastic polyurethane foam as set forth in claim 1 further comprising a third isocyanate-reactive component having a weight-average molecular

weight of from 300 to 3000, a hydroxyl number of from 40 to 500, and comprising from 0.5 to 20 parts by weight of ethylene oxide based on 100 parts by weight of said third isocyanate-reactive component, wherein said second isocyanate-reactive component contains essentially no ethylene oxide.

4. A viscoelastic polyurethane foam as set forth in claim 3 wherein said second isocyanate-reactive component is used in an amount of from 20 to 45 parts by weight based on 100 parts by weight of said isocyanate-reactive blend and said third isocyanate-reactive component is used in an amount of from 5 to 30 parts by weight based on 100 parts by weight of said isocyanate-reactive blend.

5. A viscoelastic polyurethane foam as set forth in claim 4 wherein said third isocyanate-reactive component includes at least three isocyanate-reactive groups.

6. A viscoelastic polyurethane foam as set forth in claim 5 wherein said isocyanate-reactive blend is further defined as including from 50 to 70 parts by weight of said first isocyanate-reactive component, from 15 to 30 parts by weight of said second isocyanate-reactive, and from 15 to 30 parts by weight of said third isocyanate-reactive component, based 100 parts by weight of said isocyanate-reactive blend.

7. A viscoelastic polyurethane foam as set forth in claim 1 wherein said first isocyanate-reactive component has a weight-average molecular weight of from 2500 to 4000 and at least 75 parts by weight of ethylene oxide based on 100 parts by weight of said first isocyanate-reactive component.

8. A viscoelastic polyurethane foam as set forth in claim 1 wherein said second isocyanate-reactive component has 100 parts by weight of propylene oxide based on 100 parts by weight of said second isocyanate-reactive component.

9. A viscoelastic polyurethane foam as set forth in claim 3 wherein said third isocyanate-reactive component comprises at least 75 parts by weight of propylene oxide and less than 25 parts by weight of ethylene oxide based on 100 parts by weight of said third isocyanate-reactive component.

10. A viscoelastic polyurethane foam as set forth in claim 1 wherein said isocyanate-reactive blend comprises from 50 to 70 parts by weight of said first isocyanate-reactive component and from 25 to 50 parts by weight of said second isocyanate-reactive component based 100 parts by weight of said isocyanate-reactive blend.

11. A viscoelastic polyurethane foam as set forth in claim 1 wherein said foam has a glass transition temperature of from 5 to 65 degrees Celsius and a tan delta peak of from 0.75 to 1.75.

12. A viscoelastic polyurethane foam as set forth in claim 1 wherein said chain extender is present in an amount of from 5 to 30 parts by weight based on 100 parts by weight of said foam.

13. A viscoelastic polyurethane foam as set forth in claim 1 wherein said chain extender has a weight-average molecular weight of from 25 to 250.

14. A viscoelastic polyurethane foam as set forth in claim 1 wherein said chain extender has a weight-average molecular weight of less than 100.

15. A viscoelastic polyurethane foam as set forth in claim 1 wherein said chain extender has two isocyanate-reactive groups.

16. A viscoelastic polyurethane foam as set forth in claim 15 wherein said chain extender is a diol having hydroxyl groups as said isocyanate-reactive groups.

17. A viscoelastic polyurethane foam as set forth in claim 1 wherein said chain extender is further defined as having from two to six carbon atoms.

18. A viscoelastic polyurethane foam as set forth in claim 17 wherein said chain extender is selected from at least one of 1,4-butanediol, 1,3-butanediol, 2,3-butanediol, 1,2-butanediol, 1,3-propylene glycol, and 1,5-pentanediol.

19. A viscoelastic polyurethane foam as set forth in claim 17 wherein said chain extender is selected from at least one of ethylene glycol, diethylene glycol, and polyethylene glycols having a weight-average molecular weight of up to 200.

20. A viscoelastic polyurethane foam as set forth in claim 21 wherein said foam has a glass transition temperature of from 15 to 35 degrees Celsius and a tan delta peak of from 0.9 to 1.5.

21. A viscoelastic polyurethane foam as set forth in claim 1 wherein said isocyanate component is further defined as:

pure diphenylmethane diisocyanate in an amount of from 50 to 99 parts by weight based on 100 parts by weight of said isocyanate component; and

polymeric diphenylmethane diisocyanate in an amount from 1 to 50 parts by weight based on 100 parts by weight of said isocyanate component.

22. A viscoelastic polyurethane foam as set forth in claim 21 wherein said pure diphenylmethane diisocyanate is further defined as:

diphenylmethane-2,4'-diisocyanate in an amount of from 1 to 45 parts by weight based on 100 parts by weight of said pure diphenylmethane diisocyanate; and

diphenylmethane-4,4'-diisocyanate in an amount from 55 to 99 parts by weight based on 100 parts by weight of said pure diphenylmethane diisocyanate.

23. A viscoelastic polyurethane foam as set forth in claim 1 wherein said isocyanate component is further defined as an isocyanate-terminated prepolymer.

24. A viscoelastic polyurethane foam as set forth in claim 23 wherein said prepolymer comprises a reaction product of an isocyanate and a polyol having a weight-average molecular weight greater than 1,000, said polyol used in an amount of from 1 to 20 parts by weight based on 100 parts by weight of said isocyanate component.

25. A viscoelastic polyurethane foam as set forth in claim 1 wherein said reaction product further comprises a cross-linker in an amount of from 2 to 18 parts by weight based on 100 parts by weight of said foam.

26. A viscoelastic polyurethane foam as set forth in claim 25 wherein said cross-linker is further defined as an amine-based cross-linker.

27. A viscoelastic polyurethane foam as set forth in claim 26 wherein said amine-based cross-linker is selected from at least one of triethanolamine, diethanolamine, and ethylene diamine.

28. A viscoelastic polyurethane foam as set forth in claim 1 wherein said reaction product further comprises a monol in an amount of from 1 to 15 parts by weight based on 100 parts by weight of said foam.

29. A viscoelastic polyurethane foam as set forth in claim 28 wherein said monol is selected from at least one of benzyl alcohol, 2,2-dimethyl-1,3-dioxolane-4-methanol, and alcohol ethoxylate.

30. A viscoelastic polyurethane foam as set forth in claim 1 wherein said reaction product further comprises a cell opener having at least one of a paraffinic, cyclic, and aromatic hydrocarbon chain in an amount of from 1 to 15 parts by weight based on 100 parts by weight of said foam.

31. A viscoelastic polyurethane foam as set forth in claim 30 wherein said cell opener is mineral oil.

32. A composition for use in preparing a viscoelastic polyurethane foam having a density of greater than two and a half pounds per cubic foot and being substantially free of flame retardant, said composition comprising:

an isocyanate component substantially free of toluene diisocyanate;

an isocyanate-reactive blend comprising,

a first isocyanate-reactive component having a weight-average molecular weight of from 2500 to 4500, a hydroxyl number of from 30 to 50, and comprising at least 60 parts by weight of ethylene oxide based on 100 parts by weight of said first isocyanate-reactive component, and

a second isocyanate-reactive component having a weight-average molecular weight of from 1000 to 6000, a hydroxyl number of from 20 to 500, and comprising at most 30 parts by weight of ethylene oxide based on 100 parts by weight of said flexible isocyanate-reactive component,

wherein said first isocyanate-reactive component is present in an amount of from 40 to 75 parts by weight and said second isocyanate-reactive component is present in an amount of from 25 to 60 parts by weight of based on 100 parts by weight of said isocyanate-reactive blend; and

a chain extender having a weight-average molecular weight of less than 1000 and having a backbone chain of from two to eight carbon atoms, wherein said chain

extender is present in an amount of from 5 parts by weight to 50 parts by weight based on 100 parts by weight of said composition.

33. A composition as set forth in claim 32 wherein said second isocyanate-reactive component includes at least three isocyanate-reactive groups.

34. A composition as set forth in claim 32 further comprising a third isocyanate-reactive component having a weight-average molecular weight of from 300 to 3000, a hydroxyl number of from 40 to 500, and comprising at most 30 parts by weight of ethylene oxide based on 100 parts by weight of said third isocyanate-reactive component, wherein said second isocyanate-reactive component contains essentially no ethylene oxide.

35. A composition as set forth in claim 34 wherein said second isocyanate-reactive component is present in an amount of from 20 to 45 parts by weight based on 100 parts by weight of said isocyanate-reactive blend and said third isocyanate-reactive component is present in an amount of from 5 to 30 parts by weight based on 100 parts by weight of said isocyanate-reactive blend.

36. A composition as set forth in claim 35 wherein said third isocyanate-reactive component includes at least three isocyanate-reactive groups.

37. A composition as set forth in claim 36 wherein said isocyanate-reactive blend is further defined as including from 50 to 70 parts by weight of said first isocyanate-reactive component, from 10 to 35 parts by weight of said second isocyanate-reactive, and from 5 to 10 parts by weight of said third isocyanate-reactive component based 100 parts by weight of said isocyanate-reactive blend.

38. A composition as set forth in claim 32 wherein said chain extender is present in an amount of from 5 to 30 parts by weight based on 100 parts by weight of said composition.

39. A composition as set forth in claim 32 wherein said chain extender has a weight-average molecular weight of from 25 to 250.

40. A composition as set forth in claim 32 wherein said chain extender is selected from at least one of 1,4-butanediol, 1,3-butanediol, 2,3-butanediol, 1,2-butanediol, 1,3-propylene glycol, and 1,5-pentanediol.

41. A composition as set forth in claim 32 wherein said isocyanate component is further defined as:

pure diphenylmethane diisocyanate present in an amount of from 50 to 99 parts by weight based on 100 parts by weight of said isocyanate component; and

polymeric diphenylmethane diisocyanate present in an amount from 1 to 50 parts by weight based on 100 parts by weight of said isocyanate component.

42. A composition as set forth in claim 32 wherein said composition further comprises a cross-linker present in an amount of from 2 to 18 parts by weight based on 100 parts by weight of said composition.

43. A composition as set forth in claim 32 wherein said composition further comprises a monol present in an amount of from 1 to 15 parts by weight based on 100 parts by weight of said composition.

44. A composition as set forth in claim 32 wherein said composition further comprises a cell opener having at least one of a paraffinic, cyclic, and aromatic hydrocarbon chain and present in an amount of from 1 to 15 parts by weight based on 100 parts by weight of said composition.

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